To: Gene Liu
From: Todd Wilson

Subject: Response to letter from Mr. Jim Holst of the Florida Department of Environmental Protection on an Open Burn/Open Detonation (OB/OD) site in Florida.

Enclosed is the text of the electronic mail and the responses to the questions provided within the text. I have also forwarded several additional documents for FDEP review. These documents include the Memorandum for 99 ABW/EMR to Bernd Schmidt dated 5 January 1996 describing explosives and potential hazardous constituents. No classified material was provided within this memo. The information was compiled from the Air Force technical orders. I have also forwarded the Los Alamos report, "Fate of selected high explosives in the environment: A literature review," by Naomi Becker, LAUR-95-1018, March 1995.

Dear Gene,

My name is Jim Holst and I'm with the Florida Department of Environmental Protection, Hazardous Waste Regulation Section. Your name was given to me by Mr. Greg Brown. We have a RCRA site that was an open burn/open detonation unit. Our RCRA permit requires that the facility sample for (among other things) EPA method 8330 in soils and groundwater. The facility has requested that we drop this requirement in groundwater monitoring. We have a few questions about explosives that Mr. Brown thought you may be able to help us.

1. What is the chemistry of an explosion? Are the explosives totally consumed? Are they converted to something else that we can monitor (besides, I assume nitrites and nitrites)?

A: Explosives are consumed, for the most part, within the detonation process. Minor residual explosives will remain intact, and the remainder will be volatilized to form oxide gases, polycyclic aromatic hydrocarbons, etc. Depending upon the material used at the site, there will be little to no residual remaining. Many ranges use marking charges and practice rounds rather than the fully charged explosive round. The USACE has collected samples at several ranges within and around craters and have found some explosives, but no significant detections. Some of the detections were from metals, potentially due to the use of marking charges and shrapnel from the bombs. Most practice bombs contain a marking charge, approximately the size of a shotgun shell, to allow for scoring of the training runs.

Any explosives that remain are generally bound to the soil. The explosives will then be biodegraded from the nitro groups to amines and so forth. Some of the breakdown products are provided in the Los Alamos report. Nitrates/nitrites could be the eventual end product.

2. If there is a residue behind, how stable/persistent is it? We would be looking at three depths of soil: 0-1 foot, 2-3 foot and at the water table (around 3 or 4 feet deep). This site was also used to bury unexploded munitions which may or may not still be active, some munitions date from WWII. Would there be other byproducts/degradation products that we should consider?

A: The persistence of the residue will depend upon the organic content of the soil and the soil type. Highly organic soils and clay rich soils will bind more material than sands and gravels. For the most part, explosives (TNT and DNT) are highly insoluble in water. Therefore, they will not migrate through organic and clay rich soils. Migration through sands and gravels will be sporadic. The site should not have detections of explosives at depth. If bombs were buried, the explosives would be contained within the munition. There would be no leaching of material from the munition to the soils, and no byproducts could be measured. The only potential to find byproducts/degradation products would be if a munition was "broken" during burial. This would have created an explosion hazard at the time of burial and would be avoided at all costs.